

**K<sub>sp</sub> Problems Worksheet #4**  
Review over all types of K<sub>sp</sub> Problems

1. Write the equilibrium expression for the solubility product constant (K<sub>sp</sub>) for AgBr.
2. What is the molar solubility (maximum molarity) of Ag<sup>+</sup> in a saturated solution of AgBr?
3. What is the molar solubility of AgBr in a 0.015 M KBr solution?
4. Would a precipitate be observed if the following were mixed?  
100.0 mL of 0.00015 M AgNO<sub>3</sub> and 20.0 mL of 0.00050 M NaBr
5. A person adds solid AgNO<sub>3</sub> crystals into a large beaker containing a mixture of 0.0022 M KCl and 0.00011M KBr until a precipitate begins to form. Was the observed precipitate AgCl or AgBr?

6. What is the molar solubility of  $\text{CaSO}_4$  in pure water at  $25^\circ\text{C}$ ?

7. What is the molar solubility of  $\text{CaF}_2$  in pure water at  $25^\circ\text{C}$ ?

8. At  $10^\circ\text{C}$ ,  $8.9 \times 10^{-5}$  g of  $\text{AgCl}_{(s)}$  will dissolve in 100. mL of water. *Cannot use our pink sheet since its values are based on a temperature of  $25^\circ\text{C}$ .*

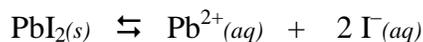
(i) Write the equation for the dissociation of  $\text{AgCl}_{(s)}$  in water.

(ii) Calculate the maximum molarity of  $\text{AgCl}_{(s)}$  in water at  $10^\circ\text{C}$ .

(iii) Calculate the value of the solubility-product constant,  $K_{sp}$  for  $\text{AgCl}_{(s)}$  at  $10^\circ\text{C}$ .

9. Answer the following questions that relate to the solubility of salts of lead and barium.

- (a) A saturated solution is prepared by adding excess  $\text{PbI}_2(s)$  to distilled water to form 1.0 L of solution at  $25^\circ\text{C}$ . The concentration of  $\text{Pb}^{2+}(aq)$  in the saturated solution is 0.0013 M. The chemical equation for the dissolution of  $\text{PbI}_2(s)$  in water is shown below.



- (i) Write the equilibrium-constant expression for the equation.
- (ii) Calculate the molar concentration of  $\text{I}^{-}(aq)$  in the solution.
- (iii) Calculate the value of the equilibrium constant,  $K_{sp}$ .
- (b) A saturated solution is prepared by adding  $\text{PbI}_2(s)$  to distilled water to form 2.0 L of solution at  $25^\circ\text{C}$ . What are the molar concentrations of  $\text{Pb}^{2+}(aq)$  and  $\text{I}^{-}(aq)$  in the solution? Justify your answer.
- (c) Solid NaI is added to a saturated solution of  $\text{PbI}_2$  at  $25^\circ\text{C}$ . Assuming that the volume of the solution does not change, does the molar concentration of  $\text{Pb}^{2+}(aq)$  in the solution increase, decrease, or remain the same? Justify your answer.

(d) When a 500. mL sample of  $8.2 \times 10^{-6} M$   $\text{Ba}(\text{NO}_3)_2$  is added to 500. mL of  $8.2 \times 10^{-6} M$   $\text{Na}_2\text{CrO}_4$ , no precipitate is observed. The value of  $K_{sp}$  for the salt  $\text{BaCrO}_4$  is  $1.2 \times 10^{-10}$ .

(i) Calculate the molar concentrations of  $\text{Ba}^{2+}_{(aq)}$  and  $\text{CrO}_4^{2-}_{(aq)}$  in the combined 1.00 L of solution.

(ii) Use the molar concentrations of  $\text{Ba}^{2+}_{(aq)}$  ions and  $\text{CrO}_4^{2-}_{(aq)}$  ions as determined above to show why a precipitate does not form. You must include a calculation as part of your answer.